Low-Spin Termination of the Superdeformed Band in ^{135}Nd

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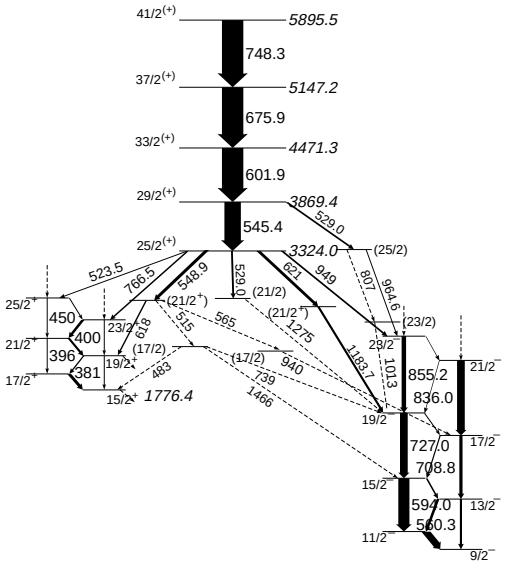
In an effort to understand the decay out of superdeformed (SD) bands, the nucleus ^{135}Nd was studied with the early implementation of Gammasphere at the 88-Inch Cyclotron of the Lawrence Berkeley National Laboratory. In two separate experiments, the reaction ^{40}Ar on ^{100}Mo at 182 and 176 MeV produced 1.0x10^{9} and 1.8x10^{9} three and higher fold suppressed events, respectively. Both angular correlations and triple γ coincidences were used to construct the level scheme of Fig. 1. A total of 75% of the decay of the SD band (and 84% of the decay of the 3.324 MeV state) has been placed in the level scheme. These results determine the spins of the SD states. Also the proposed positive signature is consistent with the $i_{13/2}$ neutron configuration previously assigned. The intensity of the linking transitions, together with previous RDM lifetime measurements [1] indicate that the observed E2 linking transitions have a reduced transition probability that is a factor about 10 lower than that of a SD band transition. Therefore, we propose that the band ceases to exist below the 3.324 MeV energy level.

Ultimate Cranker calculations with pairing, in which the $i_{13/2}$ configuration could be followed, were used to try to understand this behavior. The results show that, as the frequency decreases, a lower-deformation triaxial minimum competes with the SD minimum and the nucleus "slides over" from a high-deformation to the triaxial minimum. The rapid change is a consequence of pair correlations. The pair field will scatter pairs between the neutron levels ($h_{9/2} \leftrightarrow g_{7/2}$) and proton levels ($h_{11/2} \leftrightarrow g_{7/2}$) distinguishing the two minima. The example of ^{135}Nd clearly demonstrates the importance of underlying structural changes in the decay of highly deformed configurations [2]. Such configurations could play the role of doorway states in other decays of SD bands in which a larger number of pairs is rearranged.



References

[1] P. Willsau et al., Phys.Rev.C48, R494 (1993).

[2] M.A. Deleplanque et al., Phys.Rev.C52, R2302 (1995).